

CLAIMS

What is claimed is:

1. A tool for making an incision in and removing tissue from a vessel wall,
comprising:
 - a cutter; and
 - a piercing member positioned within said cutter, wherein said piercing
member and said cutter are configured to translate together to penetrate
the wall of the vessel.
2. The tool of claim 1, wherein said piercing member is configured to allow rotation
relative to said cutter.
3. The tool of claim 1, wherein said piercing member is rotationally fixed to said
cutter.
4. The tool of claim 1, wherein said cutter is a curved blade having a substantially
circular distal end.
5. The tool of claim 1, wherein said cutter is a curved blade having an open perimeter
at its distal end.
6. The tool of claim 1, wherein the distal end of said cutter is beveled inward.
7. The tool of claim 1, wherein the distal end of said cutter is beveled outward.

8. The tool of claim 1, wherein the distal tip of said piercing member extends further in the distal direction than the distal end of said cutter.

9. The tool of claim 1, wherein said piercing member holds the tissue removed from the wall of the vessel.

10. The tool of claim 1, wherein said cutter is substantially hemostatic.

11. The tool of claim 1, wherein said piercing member is an auger.

12. The tool of claim 11, wherein said auger and said cutter are substantially coaxial.

13. The tool of claim 11, wherein said auger comprises:

a spike;

a shaft connected to and extending distally from said spike, said shaft fixed to said cutter.

14. The tool of claim 13, wherein said spike is substantially conical at its distal end.

15. The tool of claim 14, wherein the width of the proximal end of said spike is greater than the width of said shaft.

16. The tool of claim 11, wherein at least one flute is defined in said auger.

17. A surgical tool for removing tissue from the wall of a vessel to create an opening,

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comprising:

a rotatable cutter;

an auger assembly fixed to and substantially coaxial with said cutter, said

auger assembly comprising an auger at its distal end;

an actuator connected to at least one of said auger assembly and said cutter.

18. The surgical tool of claim 17, wherein said actuator is a flexible shaft.

19. The surgical tool of claim 17, wherein said actuator is a coil spring.

20. The surgical tool of claim 17, wherein said actuator is retractable.

21. The surgical tool of claim 17, wherein said actuator extends away from the axis of said cutter.

22. The surgical tool of claim 17, wherein said cutter is vented.

23. The surgical tool of claim 22, wherein said auger further comprises at least one centering flange between and connected to said auger and said cutter, wherein each said centering flange comprises a slot extending therethrough.

24. The surgical tool of claim 23, wherein at least one centering flange comprises a substantially circumferential groove defined therein.

25. The surgical tool of claim 17, further comprising a casing, said casing comprising

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a contact structure at its distal end, wherein said auger and said cutter translate relative to said contact structure.

26. The surgical tool of claim 25, wherein said contact structure has an open perimeter.

27. The surgical tool of claim 25, wherein said auger and said cutter translate distally a selected amount relative to said contact structure.

28. The surgical tool of claim 17, further comprising a knob operatively connected to said actuator.

29. The surgical tool of claim 28, wherein said knob is rotatable through two or more positions, and wherein actuation of said auger and said cutter is controlled by rotation of said knob.

30. The surgical tool of claim 17, further comprising
a seal housing; and
an introducer tip connected to said seal housing, wherein said auger and said cutter are configured to slide through said introducer tip.

31. The surgical tool of claim 30, wherein said auger and said cutter are configured for withdrawal into said seal housing.

32. The surgical tool of claim 30, wherein said introducer tip is expandable.

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33. The surgical tool of claim 30, wherein said seal housing comprises at least one guide.

34. The surgical tool of claim 33, further comprising a bushing connected to said actuator, said bushing comprising at least one guide follower configured to engage said guide.

35. The surgical tool of claim 33, wherein said introducer defines a first axis, and wherein said guide extends away from said first axis.

36. The surgical tool of claim 33, wherein said introducer defines a first axis, and wherein said actuator is moveable in a direction at an angle to said first axis.

37. The surgical tool of claim 17, wherein the distal end of said auger extends distally beyond the distal end of said cutter.

38. The surgical tool of claim 17, further comprising an impulse source configured to rotate and translate said auger and said cutter.

39. The surgical tool of claim 38, wherein said impulse source is a spring.

40. The surgical tool of claim 38, further comprising:

 a rotatable first driveshaft connected to said actuator; and

 a axially fixed first gear comprising an opening through which said first

driveshaft extends, wherein said first driveshaft is slidable relative to said first gear, and wherein rotation of said first gear causes said first driveshaft to rotate.

41. The surgical tool of claim 40, wherein said first driveshaft comprises at least one rib aligned extending substantially radially outward and said first gear comprises a passage therethrough configured to engage said at least one rib.

42. The surgical tool of claim 31, wherein said at least one rib extends substantially axially along said first driveshaft.

43. The surgical tool of claim 40, further comprising a carriage having a threaded passage therein, said first driveshaft further comprising a threaded portion configured to engage said threaded passage, wherein rotary motion of said first driveshaft causes said first driveshaft to translate distally relative to said carriage.

44. The surgical tool of claim 43, further comprising:

a second driveshaft; and

a second gear connected to said second driveshaft, said second gear

configured to engage said first gear, wherein rotation of said second

gear causes said first gear to rotate.

45. The surgical tool of claim 44, further comprising at least one registration member extending from at least one of the second driveshaft and the second gear.

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46. The surgical tool of claim 45, wherein at least one said registration member is configured to restrain said second driveshaft against rotational motion and allow translational motion.

47. The surgical tool of claim 44, further comprising:

a cam cylinder operationally connected to said auger and said cutter, said cam cylinder comprising at least one cam path defined therein; and
a knob connected to said cam cylinder.

48. The surgical tool of claim 47, wherein said auger and said cutter are actuated based on the position of said knob.

49. The surgical tool of claim 47, further comprising:

an introducer tube;
a first cam follower connected to said introducer tube; and
a second cam follower connected to said carriage;
wherein each said cam follower rides within one said cam path.

50. The surgical tool of claim 49, wherein rotation of said cam cylinder causes said at least one cam path to move relative to and cause translation of at least one said cam follower.

51. The surgical tool of claim 38, wherein said impulse source imparts angular and linear momentum to said auger and said cutter before said auger and said cutter contact the wall of the vessel.

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52. The surgical tool of claim 17, wherein said auger comprises at least one flute.

53. The surgical tool of claim 52, wherein said at least one flute has a pitch, and wherein said pitch of said flute pulls tissue proximally faster than said cutter advances.

54. A method for creating an opening in a vessel wall within a patient, comprising:
advancing a piercing member and a cutter through the vessel wall, said cutter axially fixed to and positioned at least partially around said piercing member, wherein said advancing cuts tissue from the vessel wall; and retracting said piercing member and said cutter, whereby the cut tissue is removed from the vessel wall to form an opening therein.

55. The method of claim 54, further comprising releasing a quantity of stored energy, wherein said releasing drives said advancing.

56. The method of claim 55, wherein said releasing produces an impulsive force on said auger and said cutter.

57. The method of claim 54, further comprising providing hemostasis at the opening.

58. The method of claim 54, further comprising rotating said auger and said cutter.

59. The method of claim 54, wherein said auger comprises at least one flute, said at

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least one flute engaging the tissue plug.

60. The method of claim 59, wherein said auger pulls the vessel wall proximally while said cutter advances distally.

61. The method of claim 59, wherein said auger holds the tissue plug intramurally.

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